

Claims

- [c1] 1. A wet cleaning process comprising:
an oxidation step being performed in combination with a first means for reducing Cu deposition on a cathode-like copper wiring line of a Cu-dual damascene structure, wherein the first means for reducing Cu deposition on a cathode-like copper wiring line comprises a step of purging an inert gas during the oxidation process; and an oxide etch step for washing away cupric oxide substances generated in the oxidation step by means of a cupric oxide cleaning solution.
- [c2] 2. The process of claim 1 wherein the oxidation step is used to slightly oxidize a surface of a Cu wiring line in a dual damascene structure by utilizing a diluted H_2O_2 solution.
- [c3] 3. The process of claim 1 wherein the cupric oxide cleaning solution comprises diluted HF, NH_4F , NH_2OH , or diluted HF/HCl.
- [c4] 4. The process of claim 1 wherein the cupric oxide substances generated in the oxidation step are CuO_x and $\text{Cu}(\text{OH})_2$.

- [c5] 5. The process of claim 1 wherein the cathode-like copper wiring line is electrically connected with an N^+ diffusion region of a silicon substrate.
- [c6] 6. The process of claim 1 wherein the first means for reducing Cu deposition on a cathode-like copper wiring line comprises adding a Cu corrosion inhibitor to the diluted H_2O_2 solution.
- [c7] 7. The process of claim 6 wherein the Cu corrosion inhibitor comprises benzotriazole (BTA).
- [c8] 8. The process of claim 1 wherein the first means for reducing Cu deposition on a cathode-like copper wiring line comprises reducing the H_2O_2 concentration of the diluted H_2O_2 solution to below 100:1 (v/v) of solvent to H_2O_2 .
- [c9] 9. The process of claim 1 wherein the first means for reducing Cu deposition on a cathode-like copper wiring line comprises lowering the temperature of the diluted H_2O_2 solution during the oxidation step to below 15°C.
- [c10] 10. The process of claim 1 wherein the oxide etch step for washing away cupric oxide substances generated in the oxidation step is performed in combination with a second means for reducing Cu deposition on a cathode-

like copper wiring line, wherein the second means for reducing Cu deposition on a cathode-like copper wiring line comprises increasing the pH of the cupric oxide cleaning solution to above 7.